ing centres present no trace of a wall, others possess walls more or less incomplete; but the centres are easily distinguished by the position of the pali. The septa of two or three cycles, generally twelve, sometimes fewer, rudimentary, sometimes rather distinct at their inner ends and united two by two where the pali are placed. The pali are six, prominent, sometimes one very small or absent. Columella inconspicuous.

Locality. Tahiti.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

February 20, 1884.—Prof. T. G. Bonney, D.Sc., F.R.S., President, in the Chair.

The following communications were read:—

1. "On a recent Exposure of the Shelly Patches in the Boulder-clay at Bridlington." By G. W. Lamplugh, Esq. Communicated by Dr. J. Gwyn Jeffreys, F.R.S., F.G.S.

During some long-continued windy weather in the early part of the winter of 1882–83, the Boulder-clay, usually hidden by sand and shingle, was laid bare on the foreshore at Bridlington Quay. The beds thus exposed belong to the lowest recognized part of the glacial series of Yorkshire, the "Basement Boulder-clay." Over this, parted occasionally by a little sand or gravel, comes the Purple Boulder-clay, the Laminated Clay being wholly absent. The Basement Clay thus exposed contained angular and subangular boulders, with rounded pebbles occasionally scratched, besides many crushed masses of sand, sandy gravel, and clay, forming nearly a third of the whole mass. The last, which generally contained marine remains, were very variable in shape and in lithological character. The fauna of the masses varied greatly, both in abundance and in species, those common in one mass being rare or absent in another. The shells were commonly much crushed, though whole specimens occurred occasionally. The author considered that these shell-bearing patches had once formed a part of the bed of a glacial sea, which had been invaded and ploughed up by ice, which had transported them to their present locality. He gave reasons for thinking that they have not come from the immediate neighbourhood, but probably from the north-east, having been floated by icebergs to their present places.

The paper concluded with lists of the fossils discovered (obtained, for the most part, by washing parts of the included masses). The result has been that the number of the Mollusca (examined by Dr. J. Gwyn Jeffreys) has been raised from 67 to 101, five of the additions being new to science. Four species of *Balanus* and one of *Verruca* have been identified. More than eleven species of fish have been identified with more or less certainty. These, Mr. E. T. Newton remarks, seem to be either Norwich-Crag, Red-Crag, or London-clay forms; and all may have been derived from the last-named deposit. The Ostracoda and Foraminifera, which are numerous, were described by Dr. Crosskey in an appendix.

2. "On the so-called *Spongia paradoxica*, S. Woodward, from the Red and White Chalk of Hunstanton." By Prof. T. McKenny Hughes, M.A., F.G.S.

The author described a branched structure found in the Red and White Chalk of Hunstanton, which was named *Spongia paradoxica* by S. Woodward, and has since generally been known as *Spongia* or *Siphonia paradoxica*. The beds in which this supposed sponge occurs, contain fragments of various organisms, including sponge-spicules, but no trace of structure can be found in sections of the *Spongia paradoxica*. The fragmentary state of the undoubted organic remains would indicate that they were drifted into their present position, and therefore a state of things quite unfitted for the growth of a slender branching sponge; the so-called sponge commonly occurs in layers along the bedding-planes, but frequently rises through the whole thickness of one bed and extends up into the overlying layers. It does not seem likely that it was the root of a *Siphonia* or some similar organism. Another body which has been also called *Spongia paradoxica* consists of masses of more crystalline texture, exhibiting upon weathered surfaces a network of small ridges enclosing cup-like depressions. These appearances were compared by the author to the weathered surfaces often seen in certain beds of the Mountain Limestone and in gypsum; the masses show no traces of internal structure.

The author stated that sections of these bodies show exactly the same characters as the containing rock, except that the material is more compactly crystalline; it contains the same fragments of shell, &c., and the same sand and pebbles. He regarded them as of concretionary origin, and explained their symmetry of form and regularity of arrangement by their being formed at the intersections of joints with the bedding-planes or with one another. Phosphatic nodules occur in the lower parts of the White Chalk, and had these bodies been sponges they would probably have been phosphatized; but analyses have shown no marked difference in this respect between their substance and that of the surrounding rock.

March 5, 1884.—Prof. T. G. Bonney, D.Sc., F.R.S., President, in the Chair.

The following communication was read:—

1. "On the Structure and Formation of Coal." By E. Wethered, Esq., F.G.S., F.C.S.

The author, having referred to the work of previous investigators, pointed out that seams of coal do not always occur in one bed, but are divided by distinct partings, some of which, as in the case of the Durham main seam, contain *Stigmariæ*. It was important to notice this feature for several reasons, but especially as the beds of coal, defined by the partings, showed differences both in quality and structure. In the case of the shallow seam of Cannock Chase they had at the top a bed of coal 1 foot 10 inches thick, the brown layers of which were made up of macrospores and microspores. The bright layers were of similar construction, except that wood-tissue sometimes appeared, also a brown structureless material, which the author looked upon as bitumen. He, however, objected to that term, and thought that hydrocarbonaceous substance would be preferable. What this hydrocarbonaceous material originated from was a question for investigation. In the lower bed of the Welsh "Four Feet" seam wood-tissue undoubtedly contributed to it; whether spores did was uncertain; it was true they could be detected in it. In the second bed of the shallow seam they had a very different coal from the upper one. It was made up almost as a whole of hydrocarbonaceous material. Very few spores could be detected. It was possible that the scarcity of these objects might be due to decomposition; but the author's investigations seemed to show that spores resisted decomposing influences more effectually than wood-tissue, which seemed to account for the fact that where they occur they stand out in bold relief against the other material composing the coal. Below the central bed of the shallow seam came the main division. In it the author detected a large accumulation of spores, but hydrocarbon formed a fair proportion of the mass. The author referred to other seams of coal from various parts of England, and pointed out the structure of each bed composing them. The conclusions on the evidence elicited from his investigations were (1) that some coals were practically made up of spores, others were not, these variations often occurring in the beds of the same seam; (2) that the so-called bituminous coals were largely made up of the substance which the author termed hydrocarbon, to which wood-tissue undoubtedly contributed.

An appendix to the paper, written by Prof. Harker, Professor of Botany and Geology at the Royal Agricultural College, Cirencester, dealt with the determination of the spores seen in Mr. Wethered's microscopic sections. Taking the macrospores, the resemblance to those of *Isoëtes* could not fail to strike the botanist. He had procured some herbarium specimens of *Isoëtes lacustris* in fruit, and

compared the spores with those from the coal. When gently crushed, the identity of the appearance presented by these forms from the coal was very striking. The triradiate markings of the latter were almost exactly like the flattened three radiating lines which mark the upper hemisphere of the macrospores of *Isoëtes lacustris*. The writer therefore concluded that the forms in the coal were from a group of plants having affinities with the modern genus *Isoëtes*, and from this Isoëtoid character he suggested for them the generic title of *Isoëtoides* pending further investigation.

BIBLIOGRAPHICAL NOTICES.

Notes on Natural Selection and the Origin of Species. By Francis P. Pascoe, F.L.S. London, 1884. Taylor and Francis.

Mr. Darwin having outlived the unreasoning rancour of his early critics, his works are likely for some time to come to form the text for much useful, thoughtful, and no doubt, in many cases, well-founded criticism truly so called. Mr. Pascoe's 'Notes' belong to this latter category. He admits that "no naturalist in these days doubts that species have arisen by modifications through descent;" and he offers no suggestion as to the fixation of specific characters by any means except natural selection. His object is simply to point out various classes of difficulties in the way of the acceptance of this, which is after all *the* Darwinian theory, and, in addition to apparently endorsing many of Mr. Mivart's criticisms, to insist on the view that all the characters which serve to differentiate species are "unimportant except as incipient structures, to which, as yet, no advantage can be attached." This difficulty, and it is a weighty one, is, in the present writer's opinion, partly owing to the unfortunate prominence given to the indefinite, subjective term "species" in the title of Mr. Darwin's great work. It is apparently forgotten that a "species" is not so much a series of forms similar in their main positive characters as a series isolated from other series by negative characters—in the language of logicians, "*genus et differentia*." Hence the problem of the origin of species is not one of the acquisition of positive characters, but deals with the isolation of groups of variations by the extermination of forms intermediate between the variations of one geological age and those of another. It is not the origin of specific characters, but of specific divergence or difference. Hence, admitting, as one undoubtedly must, that the positive diagnostic characters of species are very generally indifferent from the point of view of utility, they may yet have well become characteristic by the extermination of intermediate stages which may very probably have been harmful to the organism.

No one can deny the existence of a keen struggle for existence, and surely it is no "assumption" to state that in this struggle the